REMARKS

Claims 24–43 are pending and under examination in the instant application. With this amendment, Applicants amend claim 37.

In her office action mailed January 30, 2004, the Examiner has issued rejections of claims 24–34, and 37 but has not considered claim 35, 36, and 38–43 that were introduced by Applicants in their amendment and response filed November 12, 2003. An indication of the status of claims 35, 36, and 38–43 is kindly requested in the Examiner's next communication.

Amendments to the Claims

Applicants amend claim 37 to recite a "method" thereby correcting a lack of antecedent basis in the term "metal" as pointed out by the Examiner. Claim 37 now properly limits the subject matter of claim 24 from which it depends. No new matter has been introduced by this Amendment, and Applicants respectfully request entry thereof.

REJECTIONS OF THE CLAIMS

Rejections of the Claims Under 35 U.S.C. § 112 (¶ 2)

The Examiner has rejected claims 27 and 37 under 35 U.S.C. § 112 (second paragraph) as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The Examiner has noted that "mild steel 1010" constitutes a particular grade of steel but has asserted that this grade of steel is not of record. In response, Applicants attach herewith a data sheet for a commercially available sample of mild steel 1010 for the purpose of demonstrating that such a steel is known in the art. Moreover, Applicants therefore submit that the term mild steel 1010 would be familiar to one of ordinary skill in the art. Applicants respectfully point out that an Applicant is free to use terms that are familiar to one of ordinary skill in the art without burdening a patent specification with superfluous definitions. As held by the Federal Circuit: "[t]he legal standard for definiteness is whether a claim reasonably apprises those of skill in the art of its scope." *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994). Accordingly, since one of ordinary skill in the art would be familiar with the term mild steel 1010, Applicants respectfully submit that claim 27 is not indefinite and respectfully request that the rejection of record be withdrawn.

Applicants have amended claim 37 herein to correct the dependency on claim 24 thereby rendering the rejection of record moot. Accordingly, Applicants respectfully request removal of the rejection of record.

Rejections of the Claims Under 35 U.S.C. § 103(a)

The Examiner has rejected claims 24–34 under 35 U.S.C. § 103(a) as allegedly being obvious over Jayaraman, *et al., Appl. Microbio. & Biotech.*, 47:62-68 (1997) ("Jayaraman") in view of Sekine, *et al., J. Electrochem. Soc.*, 139(11):3167-3173 (1992) ("Sekine"), and Hardoyo *et al., Appl. and Environ. Microbio.*, 60(10):3485-3490 (1994) ("Hardoyo"). Applicants respectfully traverse the rejection on the grounds that the Examiner has not articulated a motivation to combine the cited references.

In her office action mailed January 30, 2004, the Examiner urges Applicants to consider the references in combination and not separately from one another. In response, Applicants kindly ask the Examiner to consider the following remarks.

The Examiner is respectfully reminded that the U.S. Patent and Trademark Office ("PTO") bears the burden of establishing a *prima facie* case of obviousness. *In re Bell*, 26 USPQ2d 1529 (Fed. Cir. 1993). In order to establish a prima facie case, the PTO must identify some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify or combine the reference teachings in the manner suggested by the PTO. *In re Rouffet*, 149 F.3d 1350, 47 USPQ2d 1453 (Fed. Cir. 1998).

Applicants' claims recite methods for reducing corrosion on a metal, comprising forming a biofilm that comprises bacteria that secrete a polyanion. As previously discussed, Jayaraman discloses a method of reducing corrosion by forming a bacterial biofilm, without disclosing use of bacteria that secrete a polyanion. The Examiner has alleged that the deficiencies of Jayaraman can be found in a combination of Hardoyo and Sekine which disclose, respectively, genetic engineering of bacteria to secrete a polyphosphate, and inhibition of corrosion of steel by certain anionic polymers. Applicants submit, however, that the Examiner has failed to provide a motivation in the cited references for their combination.

Specifically, Sekine discloses that a number of cationic and anionic polymers inhibit corrosion of steel. None of the anionic polymers disclosed by Sekine is a polyphosphate (the anion disclosed by Hardoyo); instead, they are all derivatives of either polymaleic acid or polyacrylic acid (see Sekine, Table I, p. 3168).

Hardoyo discloses a strain of *E. Coli* that has been genetically engineered to release polyphosphate. Hardoyo is silent as to secretion of other polyanionic compositions and

makes no reference to the use of polyanionic secretions for inhibition of corrosion. Because the compounds taught by Sekine are different from those taught by Hardoyo, one of skill in the art would not be motivated to either modify the teaching of Sekine to use a bacteria to produce a polyanion, or to modiy the teaching of Hardoyo to use the compounds taught therein to inhibit corrosion.

Similarly, one of ordinary skill in the art would not have been motivated to combine the teachings of either Sekine or Hardoyo with Jayaraman because there is no teaching in any of the cited references that a bacterial biofilm can be modified to secrete a corrosion-inhibiting polyanionic composition. The mere teaching of Hardoyo that bacteria can be engineered to secrete a polyphosphate is not sufficient to bridge the gap without a separate teaching in the prior art that polyphosphate itself inhibits corrosion of metals.

Accordingly, Applicants respectfully submit that the Examiner is engaging in the impermissible use of hindsight when piecing together the cited references to reach Applicants' claimed invention. The Examiner is respectfully reminded that the teaching or suggestion to make the claimed invention must be found in the prior art, not in the Applicant's disclosure. *In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991).

In conclusion, Applicants respectfully submit that the cited references in combination are not sufficient to render Applicants' claim 24 obvious and respectfully request withdrawal of the rejection of record. Furthermore, none of the cited references discloses secretion of a polypeptide by a bacterium, or use of a polypeptide to inhibit corrosion of a metal. Therefore, claims 41 and 43 are similarly non-obvious over the cited references. Dependent claims are nonobvious under 35 U.S.C. § 103 "if the independent claims from which they depend are nonobvious." 837 F.2d 1071; 5 USPQ.2d 1596; MPEP 2143.03. Accordingly, claims 25–40 and 42 are similarly nonobvious over the combination of references, and Applicants respectfully request the Examiner's acknowledgment of the same.

CONCLUSION

In view of the remarks presented hereinabove, Applicants respectfully submit that the subject application is in good and proper order for allowance. Withdrawal of the Examiner's rejections and early notification to this effect are earnestly solicited.

If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is encouraged to call the undersigned at (650) 493-4935.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (order no. 60825-0273) for the appropriate amount. A copy of this sheet is attached.

Respectfully submitted,

Date: June 1, 2004

Richard G. A. Bone

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Stainless steel is a material that we wish never was labeled "stainless" because it can do so much more than simply resist rust. The origins of stainless steel date back to the early 1900s when an English metallurgist developed a type of steel for making knives that would not rust. Technically, "Stainless Steel" is strictly a trade name applied to what are known as corrosion-resistant steels. It is a fabulous material that outperforms mild and alloy steels in so many different applications in racing that no other material can match it, and all racers should consider it as a vital element in their fabricating efforts. However, stainless steel does have some unique properties that the fabricator needs to know about before launching into a project. An interesting characteristic of many types of stainless steel is that they are non-magnetic, a quality that makes them very important in the aerospace industry. Compared to mild steel, stainless steel has superior high temperature characteristics. It is an excellent material for headers and exhaust systems, or any application where high heat is encountered.

Stainless steel is similar to mild and alloy steels; it is an alloy of iron that contains at least 12% chromium. This high chromium content retards corrosion giving the steel its "stainless" quality. There are many alloys of stainless steel, which are broken down into two basic categories:

- Chromium-nickel grades
- Straight chromium grades

The chromium-nickel grades are the more common stainless steels used in race car fabrication compared to the straight chromium types, due to the nickel content which provides excellent weldability and corrosion resistance. Also, this nickel improves some mechanical properties such as fatigue strength, toughness and ductility. People sometimes refer to stainless steels based on their chromium and nickel content: for instance, 18-8 stainless has 18% chromium and 8% nickel in it.

Stainless steel typically has a rather low carbon content, in the range of .08% to .15%, and sometimes as low as .03%. The carbon is needed for hardness, but it also can cause the stainless to become susceptible to corrosion at high temperatures. What happens is this: when chromium-

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nickel steel is heated to a temperature range of 800° to 1590°F, the carbon in the steel combines with chromium to form chromium carbides. This transformation is called carbide precipitation and reduces the corrosion resistance of the steel. The chromium is reduced in this heat-affected area and makes the steel subject to what is known as intergranular corrosion. Some stainless steels are known as low carbon grades to minimize this carbide precipitation; others, such as 321, are special alloys that reduce carbide precipitation by combining and stabilizing the chromium at elevated temperatures.

You may have heard Smokey Yunick talk about maintaining high exhaust velocity and increase scavenging by covering headers with a thermal wrap. In addition, there are companies that coat headers with a thermal barrier, typically some type of ceramic formula, in order to keep the heat inside the exhaust system. Stainless steel performs this function without the need for add-ons because it has a much lower coefficient of thermal conductivity, thereby keeping more heat inside and transmitting it to the header outlet. Radiated heat is perhaps the most important reason to wrap or ceramic coat the headers to protect the car and the driver from excessive, fatiguing high temperatures.

Typical 1010 carbon (mild) steel conducts 219% more heat per foot than do the types of stainless steel we use in header fabrication. By contrast, quite a bit more heat stays inside the stainless header tubes and does not get passed into the surrounding air. By not allowing the contraction of the cooling gases as they flow down the tubes, more exhaust velocity is retained which promotes better scavenging at the collector. This retention of velocity increases the overall header efficiency.

You've probably seen Indy cars with their enclosed engine compartments and thermal clam-shell enclosures around their turbocharger headers. They must thermally wrap their exhaust pipes just so the radiant heat off the tubes won't cause fires or melt any critical systems. In this case headers made out of mild steel would completely fail and break apart due to the severe heat retention, let alone scale and send death particles into the turbocharger, ruining the turbine blades. 321 stainless steel has excellent high temperature fatigue resistance in this enclosed application and does a darn good job of living in this hostile environment better than any other material except the ultra-high nickel content steels (such an Inconel), which are hard to find, very difficult to work with and extremely expensive.

These many characteristics, such as superior heat retention properties, high temperature fatigue resistance, and to a lesser extent, the cosmetic value of a non-rusting finish, combine to make

stainless steel an ideal choice for headers and exhaust systems. Such a system will produce more horsepower and last "'til the cows come home". It is an excellent solution. Now that you are sold on the merits of stainless steel, there are a number of things you need to know about the different types available before you launch into a header and exhaust system project.

A three-digit numerical classification system is used throughout the industry. The racer needs to be familiar with only one of these three-digit series within the system - the 300 series. They offer the fabricator a wide array of choices, from ornamental quality up through the highest-temperature and closest-tolerance aircraft quality.

Within the 300 series of stainless steels, there are four types that are suitable, available and cost effective for the racer. These are 304, 316L, 321, and 347.

> ***321 and 347*** are known as stabilized grades of stainless. These are alloyed with either titanium (321) or columbium (347), both of which have a much stronger affinity for carbon than does chromium at elevated temperatures. This eliminates carbide precipitation leaving the chromium where it belongs for corrosion protection...remember our discussion of intergranular corrosion? Both 321 and 347 are top choices for exhaust headers, especially turbocharger systems and rotary engines. Since 321 is much more available than 347, that leaves 321 as the first choice, with no sacrifice in needed qualities.

> ***316L*** is an extra low carbon (ELC) grade of stainless that has only .03% carbon, making less carbon available to precipitate with the chromium. It is used extensively in marine exhausts where salt water corrosion mixed with diesel exhaust particulates and electrolysis create such a horrible environment that even other grades of stainless cower and run away!

> ***304*** is the most inexpensive and available stainless in the 300 series. It is suitable for normally-aspirated header applications, and has been successfully used by many racing teams. It does not have the high temperature fatigue resistance that 321 does, but is considerably less costly and much more available. Most 304 tubing these days has the dual designation of 304/304L.

Practically speaking, there are overlapping applications of 304 and 321 stainless in header construction, but knowing you've got the insurance of the aircraft-grade 321 for the job is definitely worth consideration of the extra cost... if your application requires it.

Stainless steels come in both tubing and pipe sizes. Since certain pipe sizes are almost identical in dimension to tubing sizes, pipe may sometimes be substituted for tubing, and vice versa. Numerous wall thicknesses are available, but for headers, normally .049" (18-gauge) to .065" (16-gauge) is used.

Different specifications are used to meet particular requirements for the military (MIL), the American Society of Testing Materials (ASTM), and the Society of Automotive Engineers (SAE). Examples of what to look for when you order stainless tubing are as follows:

ASTM A-554 304 stainless is a welded mechanical tubing used primarily for ornamental purposes. It is not fully annealed and is work-hardened slightly in manufacturing. It has good column strength and good bendability.

ASTM A-269 304 stainless is a general service commercial specification that is higher quality and is fully annealed for better ductility. It is available in both welded seam and seamless, and is a good spec for the racer to use. We have not seen any difference in longevity between welded seam and seamless stainless tubing in header use, but there is a substantial cost difference. The column strength is not as good as A-554, but it has excellent bendability with a higher cost due to the full annealing.

MIL-T-8808/8606\MIL-T-6737 321 stainless are military specifications for aircraft tubing. Suffice it to say that some MIL-specs are not necessarily better or even as good as some ASTM standards. There is no particular magic here.

There are as many uses for stainless steel as there are projects in the shop. There is nothing else that transmits an image of quality and skill to the majority of fabricators than a cleanly constructed stainless steel project. Whether it is a set of headers, intake stacks, or even a stand for one's dyno engine cooling fan, stainless steel has such great mechanical properties that its use should be considered for many projects beyond exhaust systems

Material Properties		Aluminum 6061-T6	Aluminum 6061-T0	Mild Steel 1010 CREW	304 Stainless Annealed ASTM A269	321 Stainless Annealed	Titanium Cp2 Grade 2 ASTM B 338	Inconel 625
Tensile Strength	lb/in^2 (70 F)	45,000	18,000	55,000	85,000	90,000	50,000	140,000

Yield Strength	lb/in^2 (70 F)	40,000	8,000	40,000	35,000	35,000	40,000	77,000
Elongation	percent	12	25	20	55	55	20	47
Density	lb/in^2	0.098	0.098	0.283	0.290	0.290	0.163	0.305
Modulus of Elasticity	x 106 lb/in^2	10	10	29.5	28	28	15	30
Coefficient of Thermal Expansion	in/in-F x 10^6 (70 F)	13.1	13.1	7.228	9.9	9.6	4.8	5.5
Coefficient of Thermal Conductivity	BTU/ft-hr-F (70 F)	96.50	104.00	26.98	9.40	9.30	12.00	5.65

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